

# Development of a STEM Program for Teachers: A Collaboration Between College of Education and College of Engineering



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## Abstract

The School of Engineering and The School of Education currently collaborate on developing a new science, technology, engineering and mathematics (STEM) curriculum for secondary science teachers. This interdisciplinary initiative is intended to improve the practices of STEM teachers, result in improved interest in STEM careers in K-12 schools, and develop a robust collaborative relationship between STEM departments and education departments. This initiative also plays an important role in the early development of a STEM program in the School of Education.

## Rationale

National Academy of Sciences (2005) and National Research Council (2009) have long emphasized rigorous content education during STEM teacher preparation and called for enhanced content-driven professional development augmented with improved classroom practice, long-term mentoring, and high-quality curricular materials. Additionally, the American Association for the Advancement of Science (2009) has specified that an understanding of the brain — including aspects about the mind/body relationship, factors that shape behavior, new ways of thinking and learning — be considered essential to science literacy. Moreover, the neuroscience community has developed its own set of core concepts that STEM teachers should know about the brain and nervous system and has correlated those concepts to the national science education standards (Society for Neuroscience, 2007). Also considering the increased teacher shortage in STEM areas, STEM teacher education program are prompted to address the content, pedagogical and professional needs of future and present STEM teachers.

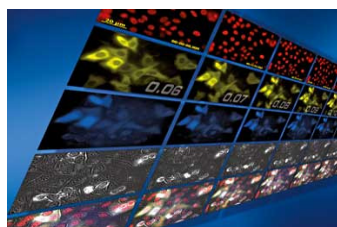
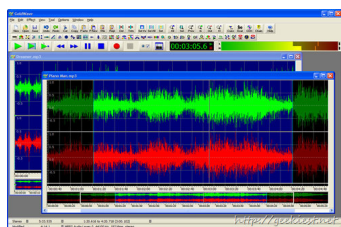
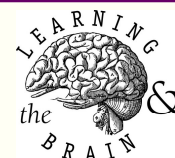


## Method

- Development of a new STEM-based course (Neuroscience for Teachers)
- Improvement of an existing course (STEM for Teacher Educators)
- Provision of high-quality continuing professional development opportunities to in-service science teachers.

## Program Objectives

- To provide specialized, in-depth and advanced knowledge and skills for STEM teachers.
- To improve the practices of STEM teachers with the purpose to result in improved interest in STEM careers in schools;
- To increase the satisfaction, motivation and commitment of STEM teachers;
- To develop a robust collaborative relationship between STEM departments and education departments.



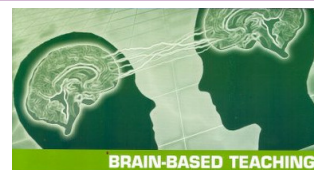
## Course Improvement: STEM for Teacher Educators

This course offers base-level information on the theory and use of digital audio and image processing approaches and technologies to teach fundamental STEM concepts to secondary pre- and in-service mathematics and science teachers.

Improvements will consist in: (a) teaching basic knowledge on digital signal processing and technology with a creative interaction between music, speech, image and technology for STEM-related courses such as mathematics, biology, and physics, and (b) assisting teachers with the preparation of materials to use in their classrooms.

### Objectives of the course:

- Develop knowledge and understanding about the practical and real world applications of audio (voice, speech, music) and image processing;
- Be able to prepare instructional course materials;
- Be able to conduct hands-on activities as part of teaching these topics;
- Become familiar with audio and image processing hardware and software;
- Value and appreciate new technologies that enhance STEM learning.



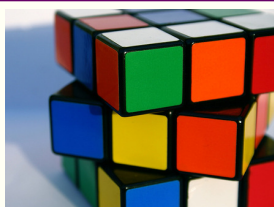
## Course Development: Neuroscience for Teachers

This course will provide participants with an overview of human cognitive development, including theory and research concerning new advances in neurosciences pertaining to the specific processes that promote and interfere with learning.

The goals of this course are: (a) to teach how the learning processes take place in the brain; (b) to expose participants to recent research findings in the field of neuroscience applied in education, and (c) to prepare brain-based instructional materials for pre- and in-service teachers to use in their classrooms.

### Objectives of the course:

- Digest relevant research findings in cognitive neuroscience and their potential implications for education research, policy and practice;
- Examine the ways in which the human brain learns;
- Develop a model of educational practice that reflects an understanding of educational neuroscience;
- Operationalize this model within the context of particular learning environments.



## Course Outcomes:

Candidates will complete course assignments that will consist in choosing a teaching topic and developing course materials designed to incorporate key course elements.

Examples are:

- Development of a teaching unit designed to promote problem solving skills at a particular grade level or over several grade levels.
- Design of a teaching unit that incorporates all principles of brain-based learning.

